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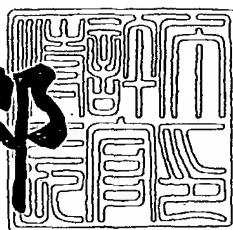
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What is claimed is:

1       1. A compiler apparatus for generating an instruction code  
2       composed of instruction sets each including an instruction that  
3       designates an  $m$ -bit immediate value indicating a location of  
4       a data item in a memory area, comprising:

5               an allocation data selecting unit operable to sequentially  
6       select a data item from a group X composed of a plurality of  
7       data items each having a plurality of data attributes, the  
8       selection being made based on a first criterion relating to one  
9       of the data attributes;

10               an allocation judging unit operable to judge, each time  
11       a data item is selected, whether the selected data item is  
12       allocatable to an  $n$ -byte memory area, where  $n \leq 2^m$ ; and

13               an exclusion data specifying unit operable to specify,  
14       when the judgment is negative, a data item to be excluded from  
15       the group X out of all data items having been selected, the  
16       specification being made based on a second criterion relating  
17       to a different one of the data attributes, wherein

18               the allocation data selecting unit repeats the selection  
19       from data items that remain in the group X after excluding all  
20       data items having been specified to be excluded, until all the  
21       remaining data items are judged to be allocatable to the memory  
22       area.

1       2. The compiler apparatus according to Claim 1, wherein  
2       the first criterion is a descending order of an alignment

3 of each data item, the alignment being a value representing a  
4 strength of a constraint on an allocatable location of a  
5 corresponding data item in a memory area,

6 the allocation data selecting unit selects a data item  
7 in the descending order of an alignment of each data item,

8 the second criterion is a descending order of a size of  
9 each data item, and

10 the exclusion data specifying unit specifies a data item  
11 in the descending order of a size of each data item.

1 3. The compiler apparatus according to Claim 2, further comprises  
2 a re-allocation data selecting unit operable to  
3 sequentially select, after the allocation data selecting unit  
4 completes the selection, a data item from the excluded data items,  
5 the selection by the re-allocation data selecting unit being  
6 made in an ascending order of a size of each data item, wherein  
7 the allocation judging unit further judges, each time a  
8 data item is selected by the re-allocation data selecting unit,  
9 the selected data item is allocatable to the memory area.

1 4. The compiler apparatus according to Claim 1, wherein  
2 the allocation data selecting unit further sequentially  
3 selects, after completing the selection, a data item from the  
4 excluded data items, the further-selection being made based on  
5 the first criterion,

6 the allocation judging unit further judges, each time a  
7 data item is further-selected, whether the further-selected data

8 item is allocatable to another memory area,

9 the exclusion data specifying unit further specifies, when  
10 the further judgment is negative, a data item to be re-excluded  
11 from the excluded data items out of all data items having been  
12 further-selected, the further specification being made based  
13 on the second criterion, and

14 the allocation data selecting unit repeats the  
15 further-selection from data items that remain after excluding  
16 all data items having been further specified to be re-excluded,  
17 until all the remaining data items are judged to be allocatable  
18 to said another memory area, and

19 when there are any re-excluded data items after completing  
20 the further-selection,

21 the allocation data selecting unit further selects a data  
22 item sequentially from the re-excluded data items,

23 the allocation judging unit further judges, each time a  
24 data item is further selected from the re-excluded data items,  
25 whether the further-selected data item is allocatable to a yet  
26 another memory area, and

27 the exclusion data specifying unit further specifies a  
28 data item when the further judgment is negative.

1 5. The compiler apparatus according to Claim 4, wherein

2 the first criterion is a descending order of an alignment  
3 of each data item, the alignment being a value representing a  
4 strength of a constraint on an allocatable location of a  
5 corresponding data item in a memory area, and

6           the second criterion is a descending order of a size of  
7    each data item.

1    6. The compiler apparatus according to Claim 4, wherein  
2       the first criterion is a descending order of an alignment  
3    of each data item, the alignment being a value representing a  
4    strength of a constraint on an allocatable location of a  
5    corresponding data item in a memory area, and  
6       the second criterion is an ascending order of a reference  
7    frequency of each data item, the reference frequency representing  
8    how frequently a corresponding data item is referenced.

1    7. The compiler apparatus according to Claim 1, wherein  
2       the first criterion is a descending order of an alignment  
3    of each data item, the alignment being a value representing a  
4    strength of a constraint on an allocatable location of a  
5    corresponding data item in a memory area,  
6       the allocation data selecting unit selects a data item  
7    in the descending order of an alignment of each data item,  
8       the second criterion is an ascending order of a reference  
9    frequency of each data item, the reference frequency representing  
10   how frequently a corresponding data item is referenced, and  
11       the exclusion data specifying unit specifies a data item  
12    in the ascending order of a reference frequency of each data  
13   item.

1    8. The compiler apparatus according to Claim 7, further

2 comprising

3 a re-allocation data selecting unit operable to  
4 sequentially select, after the allocation data selecting unit  
5 completes the selection, a data item from the excluded data items,  
6 the selection by the re-allocation data selecting unit being  
7 made in a descending order of a reference frequency of each data  
8 item, wherein

9 the allocation judging unit further judges, each time a  
10 data item is selected by the re-allocation data selecting unit,  
11 whether the selected data item is allocatable to the memory area.

1 9. A data location determining method for a compiler apparatus  
2 to generate an instruction code composed of instruction sets  
3 each including an instruction that designates an  $m$ -bit immediate  
4 value indicating a location of a data item in a memory area,  
5 the method comprising:

6 an allocation data selecting step of sequentially  
7 selecting a data item from a group X composed of a plurality  
8 of data items each having a plurality of data attributes, the  
9 selection being made based on a first criterion relating to one  
10 of the data attributes;

11 an allocation judging step of judging, each time a data  
12 item is selected, whether the selected data item is allocatable  
13 to an  $n$ -byte memory area, where  $n \leq 2^m$ ; and

14 an exclusion data specifying step of specifying, when the  
15 judgment is negative, a data item to be excluded from the group  
16 X out of all data items having been selected, the specification

17 being made based on a second criterion relating to a different  
18 one of the data attributes, wherein  
19 the allocation data selecting step repeats the selection  
20 from data items that remain in the group X after excluding all  
21 data items having been specified to be excluded, until all the  
22 remaining data items are judged to be allocatable to the memory  
23 area.

1 10. The data location determining method according to Claim 9,  
2 wherein

3 the first criterion is a descending order of an alignment  
4 of each data item, the alignment being a value representing a  
5 strength of a constraint on an allocatable location of a  
6 corresponding data item in a memory area,

7 the allocation data selecting step selects a data item  
8 in the descending order of an alignment of each data item,

9 the second criterion is a descending order of a size of  
10 each data item, and

11 the exclusion data specifying step specifies a data item  
12 in the descending order of a size of each data item.

1 11. The data location determining method according to Claim 9,  
2 wherein

3 the first criterion is a descending order of an alignment  
4 of each data item, the alignment being a value representing a  
5 strength of a constraint on an allocatable location of a  
6 corresponding data item in a memory area,

7           the allocation data selecting step selects a data item  
8    in the descending order of an alignment of each data item,  
9           the second criterion is an ascending order a reference  
10   frequency of each data item, the reference frequency representing  
11   how frequently a corresponding data item is referenced, and  
12           the exclusion data specifying step specifies a data item  
13   in the ascending order of a reference frequency of each data  
14   item.

1   12. The data location determining method according to Claim 9,  
2   wherein

3           the allocation data selecting step further sequentially  
4   selects, after completing the selection, a data item from the  
5   excluded data items, the further-selection being made based on  
6   the first criterion,

7           the allocation judging step further judges, each time a  
8   data item is further-selected, whether the further-selected data  
9   item is allocatable to another memory area,

10           the exclusion data specifying step further specifies, when  
11   the further judgment is negative, a data item to be re-excluded  
12   from the excluded data items out of all data items having been  
13   further-selected, the further specification being made based  
14   on the second criterion, and

15           the allocation data selecting step repeats the  
16   further-selection from data items that remain after excluding  
17   all data items having been further specified to be re-excluded,  
18   until all the remaining data items are judged to be allocatable

19 to said another memory area, and  
20 when there are any re-excluded data items after completing  
21 the further-selection,  
22 the allocation data selecting step further selects a data  
23 item sequentially from the re-excluded data items,  
24 the allocation judging step further judges, each time a  
25 data item is further selected from the re-excluded data items,  
26 whether the further-selected data item is allocatable to a yet  
27 another memory area, and  
28 the exclusion data specifying step further specifies a  
29 data item when the further judgment is negative.

1 13. The data location determining method according to Claim 12,  
2 wherein  
3 the first criterion is a descending order of an alignment  
4 of each data item, the alignment being a value representing a  
5 strength of a constraint on an allocatable location of a  
6 corresponding data item in a memory area, and  
7 the second criterion is a descending order of a size of  
8 each data item.

1 14. The data location determining method according to Claim 12,  
2 wherein  
3 the first criterion is a descending order of an alignment  
4 of each data item, the alignment being a value representing a  
5 strength of a constraint on an allocatable location of a  
6 corresponding data item in a memory area, and

7           the second criterion is an ascending order of a reference  
8   frequency of each data item, the reference frequency representing  
9   how frequently a corresponding data item is referenced.

1   15. A program for a compiler apparatus to generate an instruction  
2   code composed of instruction sets each including an instruction  
3   that designates an  $m$ -bit immediate value indicating a location  
4   of a data item in a memory area, the program comprising:

5           an allocation data selecting step of sequentially  
6   selecting a data item from a group X composed of a plurality  
7   of data items each having a plurality of data attributes, the  
8   selection being made based on a first criterion relating to one  
9   of the data attributes;

10          an allocation judging step of judging, each time a data  
11   item is selected, whether the selected data item is allocatable  
12   to an  $n$ -byte memory area, where  $n \leq 2^m$ ; and

13          an exclusion data specifying step of specifying, when the  
14   judgment is negative, a data item to be excluded from the group  
15   X out of all data items having been selected, the specification  
16   being made based on a second criterion relating to a different  
17   one of the data attributes, wherein

18           the allocation data selecting step repeats the selection  
19   from data items that remain in the group X after excluding all  
20   data items having been specified to be excluded, until all the  
21   remaining data items are judged to be allocatable to the memory  
22   area.

1 16. The program according to Claim 15, wherein  
2       the first criterion is a descending order of an alignment  
3  of each data item, the alignment being a value representing a  
4  strength of a constraint on an allocatable location of a  
5  corresponding data item in a memory area,  
6       the allocation data selecting step selects a data item  
7  in the descending order of an alignment of each data item,  
8       the second criterion is a descending order of a size of  
9  each data item, and  
10      the exclusion data specifying step specifies a data item  
11  in the descending order of a size of each data item.

1 17. The program according to Claim 15, wherein  
2       the first criterion is a descending order of an alignment  
3  of each data item, the alignment being a value representing a  
4  strength of a constraint on an allocatable location of a  
5  corresponding data item in a memory area,  
6       the allocation data selecting step selects a data item  
7  in the descending order of an alignment of each data item,  
8       the second criterion is an ascending order a reference  
9  frequency of each data item, the reference frequency representing  
10  how frequently a corresponding data item is referenced, and  
11      the exclusion data specifying step specifies a data item  
12  in the ascending order of a reference frequency of each data  
13  item.

1 18. The program according to Claim 15, wherein

2        the allocation data selecting step further sequentially  
3    selects, after completing the selection, a data item from the  
4    excluded data items, the further-selection being made based on  
5    the first criterion,

6        the allocation judging step further judges, each time a  
7    data item is further-selected, whether the further-selected data  
8    item is allocatable to another memory area,

9        the exclusion data specifying step further specifies, when  
10   the further judgment is negative, a data item to be re-excluded  
11   from the excluded data items out of all data items having been  
12   further-selected, the further specification being made based  
13   on the second criterion, and

14       the allocation data selecting step repeats the  
15   further-selection from data items that remain after excluding  
16   all data items having been further specified to be re-excluded,  
17   until all the remaining data items are judged to be allocatable  
18   to said another memory area, and

19       when there are any re-excluded data items after completing  
20   the further-selection,

21       the allocation data selecting step further selects a data  
22   item sequentially from the re-excluded data items,

23       the allocation judging step further judges, each time a  
24   data item is further selected from the re-excluded data items,  
25   whether the further-selected data item is allocatable to a yet  
26   another memory area, and

27       the exclusion data specifying step further specifies a  
28   data item when the further judgment is negative.

1 19. The program according to Claim 18, wherein  
2       the first criterion is a descending order of an alignment  
3 of each data item, the alignment being a value representing a  
4 strength of a constraint on an allocatable location of a  
5 corresponding data item in a memory area, and

6       the second criterion is a descending order of a size of  
7 each data item.

1 20. The program according to Claim 18, wherein  
2       the first criterion is a descending order of an alignment  
3 of each data item, the alignment being a value representing a  
4 strength of a constraint on an allocatable location of a  
5 corresponding data item in a memory area, and

6       the second criterion is an ascending order of a reference  
7 frequency of each data item, the reference frequency representing  
8 how frequently a corresponding data item is referenced.

1 21. A computer-readable recording medium storing thereon a  
2 program for a compiler apparatus to generate an instruction code  
3 composed of instruction sets each including an instruction that  
4 designates an  $m$ -bit immediate value indicating a location of  
5 a data item in a memory area, the program comprising:

6       an allocation data selecting step of sequentially  
7 selecting a data item from a group X composed of a plurality  
8 of data items each having a plurality of data attributes, the  
9 selection being made based on a first criterion relating to one  
10 of the data attributes;

11       an allocation judging step of judging, each time a data  
12 item is selected, whether the selected data item is allocatable  
13 to an  $n$ -byte memory area, where  $n \leq 2^m$ ; and

14       an exclusion data specifying step of specifying, when the  
15 judgment is negative, a data item to be excluded from the group  
16 X out of all data items having been selected, the specification  
17 being made based on a second criterion relating to a different  
18 one of the data attributes, wherein

19       the allocation data selecting step repeats the selection  
20 from data items that remain in the group X after excluding all  
21 data items having been specified to be excluded, until all the  
22 remaining data items are judged to be allocatable to the memory  
23 area.

1       22. The computer-readable recording medium according to Claim  
2 21, wherein

3       the first criterion is a descending order of an alignment  
4 of each data item, the alignment being a value representing a  
5 strength of a constraint on an allocatable location of a  
6 corresponding data item in a memory area,

7       the allocation data selecting step selects a data item  
8 in the descending order of an alignment of each data item,

9       the second criterion is a descending order of a size of  
10 each data item, and

11       the exclusion data specifying step specifies a data item  
12 in the descending order of a size of each data item.

1 23. The computer-readable recording medium according to Claim  
2 21, wherein

3 the first criterion is a descending order of an alignment  
4 of each data item, the alignment being a value representing a  
5 strength of a constraint on an allocatable location of a  
6 corresponding data item in a memory area,

7 the allocation data selecting step selects a data item  
8 in the descending order of an alignment of each data item,

9 the second criterion is an ascending order a reference  
10 frequency of each data item, the reference frequency representing  
11 how frequently a corresponding data item is referenced, and

12 the exclusion data specifying step specifies a data item  
13 in the ascending order of a reference frequency of each data  
14 item.

1 24. The computer-readable recording medium according to Claim  
2 21, wherein

3 the allocation data selecting step further sequentially  
4 selects, after completing the selection, a data item from the  
5 excluded data items, the further-selection being made based on  
6 the first criterion,

7 the allocation judging step further judges, each time a  
8 data item is further-selected, whether the further-selected data  
9 item is allocatable to another memory area,

10 the exclusion data specifying step further specifies, when  
11 the further judgment is negative, a data item to be re-excluded  
12 from the excluded data items out of all data items having been

13 further-selected, the further specification being made based  
14 on the second criterion, and

15 the allocation data selecting step repeats the  
16 further-selection from data items that remain after excluding  
17 all data items having been further specified to be re-excluded,  
18 until all the remaining data items are judged to be allocatable  
19 to said another memory area, and

20 when there are any re-excluded data items after completing  
21 the further-selection,

22 the allocation data selecting step further selects a data  
23 item sequentially from the re-excluded data items,

24 the allocation judging step further judges, each time a  
25 data item is further selected from the re-excluded data items,  
26 whether the further-selected data item is allocatable to a yet  
27 another memory area, and

28 the exclusion data specifying step further specifies a  
29 data item when the further judgment is negative.

1 25. The computer-readable recording medium according to Claim  
2 24, wherein

3 the first criterion is a descending order of an alignment  
4 of each data item, the alignment being a value representing a  
5 strength of a constraint on an allocatable location of a  
6 corresponding data item in a memory area, and

7 the second criterion is a descending order of a size of  
8 each data item.

1 26. The computer-readable recording medium according to Claim  
2 24, wherein

3 the first criterion is a descending order of an alignment  
4 of each data item, the alignment being a value representing a  
5 strength of a constraint on an allocatable location of a  
6 corresponding data item in a memory area, and

7 the second criterion is an ascending order of a reference  
8 frequency of each data item, the reference frequency representing  
9 how frequently a corresponding data item is referenced.